SECTION V.—SEISMOLOGY.

SEISMOLOGICAL REPORTS FOR APRIL, 1917.

W. J. HUMPHREYS, Professor in charge.

[Dated: Weather Bureau, Washington, D. C., June 2, 1917.]

TABLE 1.—*Non-instrumental earthquake reports, April, 1917.*

Date.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		ARKANSAS.								
1917.	*H. m.*		° ′	° ′			*M. s.*			
Apr. 9	20 52	Black Rock	36 08	91 04	3	1	10		Windows trembled	S. J. Howe.
		Corning	36 23	90 33	4–5	1	5	Rumbling	Shook buildings	J. N. Crutchfield.
		Hardy	36 19	91 22	3	2	60	None		A. A. Caywood.
		Marked Tree	35 32	90 22	4–5	1		do	Furniture moved	A. R. Shearon.
		Osceola	35 43	89 54	4	1	30	do		A. P. Smith.
		Paragould	36 05	90 25	2					A. S. Snowden.
		Piggott	36 22	90 10	3	1	30			J. C. Latta.
		Pocahontas	36 15	90 55	2	1	60			Benedictine Sisters.
		St. Francis	36 25	90 06	3–4	1	30	None	Hanging lamps swayed	J. A. Reed.
		CALIFORNIA.								
2	9 00	Berkeley	37 52	122 16	3–4	1	1	Rumbling		E. F. Davis.
13	4 03	Nordhoff	34 35	119 14	5	1	2	None	Concrete tower cracked	W. H. Duncan.
		Oxnard	34 12	119 08	5	3		do	Dishes rattled	Press report.
		Santa Barbara	34 23	119 40	6	1			Most severe in recent years	Do.
		Ventura	34 17	119 17	4	2				Do.
13	12 30	Cedarville	41 32	120 08	2–3	1	60	Faint		T. H. Johnstone Co.
16	6 00	Cedarville	41 32	120 08	3	1				Do.
18	23 43	Calexico	32 41	115 30	3	2	5	Rumbling		C. N. Perry.
21	6 59	Santa Barbara	34 23	119 40	4	2				Press report.
		Ventura	34 17	119 17	4	1			Awakened people	Do.
		IDAHO.								
20	4 30	Pierson	44 03	114 48	5	3	60	Rumbling		E. E. Lanning.
		ILLINOIS.								
9	20 52	Alton	38 54	90 12	5	2		None		Mildred Brown.
		Anna	37 27	89 18	4	2	9	Rumbling		J. I. Hale.
		Cairo	37 00	89 10	4	2	14	None		U. S. Weather Bureau.
		Carbondale	37 45	89 14	4	2	25	do	Windows rattled	Prof. F. H. Colyer.
		Carlinville	39 17	89 53	5	2	30	do	Radiators swayed	Dr. J. D. Conley.
		Carterville	37 46	89 05	3	2	30	do		J. J. West.
		Chester	37 55	89 50	5	1	15	Rumbling	Buildings trembled	F. C. Kennedy.
		Danville	40 09	87 36	3	1				J. J. Lemon.
		Edwardsville	38 48	89 59	5	1		None		W. H. Morgan.
		Elizabethtown	37 27	88 12	4	1			Buildings trembled	
		Equality	37 44	88 22	3	1		None		Elizabeth Davis.
		Fairview	40 38	90 12	3–4	1		do		Abram Wilson.
		Golconda	37 22	88 31	4	2		Rumbling		J. M. Ramsey.
		Grafton	38 59	90 26	5	1			Buildings shook	W. T. Bymer.
		Greenville	38 53	89 25	5	4	30			F. P. Seawell.
		Griggsville	39 42	90 43	4	2	2	None		G. F. Kneeland.
		Harrisburg	37 45	88 34	3	1		do		Clarence Bonnell.
		Highland	38 44	89 42	5	1				Chas. Schuttinger.
		McLeansboro	38 07	88 34	3	1	2	None		A. E. Wilson.
		Mascoutah	38 30	89 48	5	1	60			Dr. R. F. Lischer.
		Morrisonville	39 31	89 30	4	1		Rumbling		J. D. Lowes.
		Nashville	38 22	89 23	4	1				E. D. Garlich.
		New Athens	38 18	89 52	4	3		None		D. M. Fullmer.
		New Burnside	37 34	88 45	3	3	30	do		Miss Mae McCabe.
		Pulaski	37 15	89 11	3–4	1				H. Reeves.
		Quincy	39 55	91 22	4	1				Press report.
		Shawneetown	37 42	88 10	4	1	10	None		E. F. Armstrong.
		Springfield	39 48	89 39	4–5	2	4	do	Shook buildings	U. S. Weather Bureau.
		Sparta	38 08	89 43	3–4	1	3			W. F. Clendenin.
		Staunton	39 01	89 50	4	3		None		Mary Whalen.
		Valmeyer	38 18	90 19	5	1	25	Faint		Chas. Schaefer.
		Vienna	37 25	88 54	5	1				C. C. Clymon.
		Waterloo	38 19	90 11	5–6	3	12	Rumbling	Shook buildings	W. E. Eilbracht.
		White Hall	39 27	90 25	5	1	30	Loud		R. B. Pearce.
9	23 35	Anna	37 27	89 18	2	1	7	None		J. I. Hale.
		Valmeyer	38 18	90 19		1	9			Chas. Schaefer.
		INDIANA.								
9	20 52	Evansville	37 58	87 33	3	1		None		U. S. Weather Bureau.
		Trevlac	39 16	86 21	2	1				B. N. Doylan.
		IOWA.								
9	20 52	Cedar Rapids	41 56	91 39	2–3		20			J. W. Brush.
		Clinton	41 50	90 13	3	3		None		E. T. Carew.
		Davenport	41 30	90 38		1		do		U. S. Weather Bureau.
		Eldridge	41 38	90 35	3			do		M. H. Calderwood.
		Keokuk	40 22	91 26	3	1	2	do		U. S. Weather Bureau.
		Keosauqua	40 45	91 56	3	1	2	do		J. H. Landes.

TABLE 1.—*Non-instrumental earthquake reports, April, 1917.*

Date.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		KANSAS.								
1917.	*H. m.*		° ′	° ′			*M. s.*			
Apr. 9	20 52	Lawrence	38 58	90 15	2	1				Prof. F. E. Kester.
		KENTUCKY.								
9	20 52	Bardwell	36 53	89 01	3	2				Arthur Halteman.
		Hickman	36 35	89 11	4	2				Mrs. Ella Werner.
		Laketon	36 52	89 00	3	2				E. T. Parker.
		Milburn	36 49	88 53	3	1		None		W. R. Wilkerson.
		Paducah	37 06	88 37	5	1	15	Rumbling		E. Futrell, jr.
		Smithland	37 09	88 29	4	1	12	None		W. D. Threekeld.
		Water Valley	36 35	88 50	3					W. E. Barnes.
		Wickliffe	36 57	90 05	3-4	3	30	None		Prof. G. M. Moore.
		MISSISSIPPI.								
9	20 52	Evansville	34 38	90 19	2					J. M. Phillips.
		MISSOURI.								
9	20 52	Allenton	38 30	90 40	5-6	3			Buildings swayed	W. M. Sevier.
		Augusta	38 34	90 51	5		8	None		W. J. Hays.
		Bismarck	37 48	90 36	5	2	30			G. J. Goeltz.
		Bloomfield	36 54	89 53	4-5	1	10	None		W. E. Cooper.
		Cape Girardeau	37 20	89 31	5	3		do		H. L. Roberts.
		Columbia	38 57	92 20	3-4	1		do		U. S. Weather Bureau.
		Des Arc	37 18	90 37	5	2	30	Rumbling		W. E. McKee.
		De Sota	38 06	90 33	6			do	Bricks fell off chimneys	C. C. Mitakin.
		Doniphan	36 38	90 47	5	2		None		W. W. Martin.
		Dudley	36 48	90 04	5	2	50	do		Mrs. T. J. Fields.
		Farmington	37 47	90 24	5	2	40	Loud		J. B. Smith.
		Fredericktown	37 43	90 16	5-6	3	40			A. T. Lacey.
		Graniteville	37 38	90 44	5	2				Ella Sheahan.
		Greenville	37 07	90 25	5	1	30	Rumbling		
		Hannibal	39 41	91 20	5	1	50	None		U. S. Weather Bureau.
		Hematite	38 13	90 30	5	2		Rumbling		D. O. Jarvis.
		Hendrickson	36 50	90 26	5	1		do		J. L. Harwell.
		High Ridge	38 27	90 32	5-6	1	1 00	do		F. H. Klemme.
		Hogan	37 32	90 39	5	3		do	Many people alarmed	Bessie Wilson.
		Irondale	37 51	90 38	5-6	1	1 30	do		E. S. Tetley.
		Ironton	37 36	90 37	6	2		do	Windows broken	W. H. Delano.
		Jackson	37 25	89 40	5	1	1 00	do		L. M. Bean.
		Kansas City	39 05	94 37	3	1		None		U. S. Weather Bureau.
		Kimmswick	38 23	90 22	5-6	2		Rumbling		J. J. Hilgert.
		Manchester	38 36	90 31	5	1	1 00	do		O. N. Kulhne.
		Marquand	37 27	90 07	5	2		do		Blanche White.
		New Madrid	36 35	89 32	3					Miss Josie Smith.
		Oak Ridge	37 34	89 48	5	1		Rumbling	Dishes rattled	E. C. Trickey.
		Orchard Farm	38 51	90 27	5	2	2 00	do		F. H. Meyer.
		Palmer	37 49	90 54	5	2	11	do	Furniture moved	B. G. Halbert.
		Perryville	37 45	89 51	5	1	15	do		A. E. Deen.
		Pevely	38 17	90 30	5-6	2	4	do		H. J. Englebach.
		Poplar Bluff	36 46	90 21	4-5	1		None		Belle Kinne.
		Potosi	37 57	90 46	5-6	2	30	Rumbling		B. E. Flynn.
		Rolla	37 57	91 45	4	1	30	do	Chandeliers swayed	E. E. Harris.
		St. Charles	38 48	90 30	5	1	15	None	Many alarmed	Louis Saeger.
		St. Louis	38 38	90 12	5-6	2	6	do	Some windows broken	U. S. Weather Bureau.
		St. Marys	37 53	89 59	5	2		Rumbling		J. J. Davis.
		St. Peters	38 48	90 40	5	1	1 00	do		A. B. Iffrig.
		Ste. Genevieve	37 58	90 02	5	1	23	do		L. P. Kern.
		Salem	37 40	91 30	5					C. J. Carnico.
		Seventy Six	37 45	89 38	5	1				G. S. Hatch.
		Sikeston	36 54	89 34	4	1		None		W. E. Burnham.
		Silvermine	37 34	90 27	5	1		Rumbling		Robert Meacher.
		Steelville	37 58	91 20	5	1	5	do	Many people frightened	J. T. Haley.
		Sturdivant	37 03	90 00	4	2		Faint		B. F. Baker.
		Van Buren	36 58	91 01	4	1		None		O. Coleman.
		Warrenton	38 48	91 07	5					Press report.
		Wittenberg	37 45	89 32	5	1	30	Rumbling		C. R. Swan.
		Zion	37 26	90 17	5			do		E. Barker.
9	23 35	Bismarck	37 48	90 36	3	1				G. J. Goeltz.
		Cape Girardeau	37 20	89 31	3	1				H. L. Roberts.
		De Sota	38 06	90 33	3	1				C. C. Mitaken.
		Hematite	38 13	90 30		1	30			D. O. Jarvis.
		Irondale	37 51	90 38		1	30			E. S. Tetley.
		Ironton	37 26	90 37	4	2		Rumbling	Shook oil in lamps	W. H. Delano.
		Jackson	37 25	89 40		1	30			L. M. Bean.
		Perryville	37 45	89 51		1	6			A. E. Deen.
		St. Marys	37 53	89 59	5	1	2 00	Rumbling	Furniture moved	J. J. Davis.
		Ste. Genevieve	37 58	90 02						L. P. Kern.
		Steelville	37 58	91 20						J. T. Haley.
		Zion	37 26	90 17	4	1	1 00	Rumbling		E. Barker.
		MONTANA.								
23	3 50	Butte	46 00	112 31	4	2	10	None		Wm. Hosking.
		NEVADA.								
15	19 02	Fallon	39 30	118 48	3	1	1			E. W. Curtis.
		SOUTH CAROLINA.								
11	19 01	Summerville	33 03	80 14	1-2	1		None		Miss E. H. Gadsden.
		TENNESSEE.								
9	20 52	Hornbeak	36 19	89 21	3-4	1				D. C. Williams.
		Memphis	35 09	90 03	3	2	6	None		U. S. Weather Bureau.
		Tiptonville	36 24	89 30	4-5	1	30	..		I. F. Lemonds.
		WISCONSIN.								
9	20 52	Madison	43 05	89 23	2	2	6			U. S. Weather Bureau.

TABLE 2.—*Instrumental reports, April, 1917.*

[Time used: Mean Greenwich, midnight to midnight. Nomenclature: International.]

[For significance of symbols see REVIEW for January, 1917, p. 26.]

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. J. W. Green.

Lat. 57° 03′ 00″ N.; long., 135° 30′ 06″ W. Elevation, 15.2 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants:

	V	T_0
E	10	16
N	10	15

(No earthquake recorded during April, 1917.)

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

Lat., 32° 14′ 48″ N.; long., 110° 50′ 06″ W. Elevation, 769.6 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants:

	V	T_0
E	10	13.9
N	10	19.1

(No earthquake recorded during April, 1917.)

California. *Berkeley. University of California.*

Lat., 37° 52′ 16″ N.; long., 122° 15′ 37″ W. Elevation, 85.4 meters.

(See Bulletin of the Seismographic Stations, University of California.)

California. *Mount Hamilton. Lick Observatory.*

Lat., 37° 20′ 24″ N.; long., 121° 38′ 34″ W. Elevation, 1,281.7 meters.

(See Bulletin of the Seismographic Stations, University of California.)

California. *Point Loma. Raja Yoga Academy.* F. J. Dick.

Lat., 32° 43′ 03″ N.; long., 117° 15′ 10″ W. Elevation, 91.4 meters.

Instrument: Two-component, C. D. West seismoscope.

1917.			H. m. s.	Sec.	μ	μ	km.	
Apr. 2	.....	.....	.....	.....	*200	*200	.....	Tremors recorded during 24 hours preceding 15h on dates given.
5	.....	.....	.....	.....	*300	*600	.....	
6	.....	.....	.....	.....	*200	*200	.....	
8	.....	.....	.....	.....	*100	*100	.....	
12	.....	.....	.....	.....	*250	*200	.....	
13	.....	.....	.....	.....	*200	*200	.....	
14	.....	.....	.....	.....	*250	*350	.....	
15	.....	.....	.....	.....	*200	*250	.....	
20	.....	.....	.....	.....	*150	*200	.....	
23	.....	.....	.....	.....	*200	*200	.....	
24	.....	.....	.....	.....	*250	*250	.....	
25	.....	.....	.....	.....	*150	*150	.....	
30	.....	.....	.....	.....	*100	*200	.....	

* Amplitude on instrument.

California. *Santa Clara. University of Santa Clara.* J. S. Ricard, S. J.

Lat., 37° 26′ 36″ N.; long., 121° 57′ 03″ W. Elevation, 27.43 meters.

(See record of the Seismographic Station, University of Santa Clara.)

Colorado. *Denver. Sacred Heart College.* Earthquake Station.

A. W. Forstall, S. J.

Lat., 39° 40′ 36″ N.; long., 104° 56′ 54″ W. Elevation, 1,655 meters.

Instrument: Wiechert 80 kg., astatic, horizontal pendulum.

1917.			H. m. s.	Sec.	μ	μ	km.	
Apr. 6	.....	L_N	4 30 ..	.....	.....	.....	.....	Very small sinusoidal waves of long period.
		F_N	6 10 ..	.....	.....	.....	.....	

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Colorado. *Denver*—Continued.

1917.			H. m. s.	Sec.	μ	μ	km.	
Apr. 8	.....	L_N	12 15 ..	.....	.....	.....	.....	Recurring sinusoidal waves of long period during day. More pronounced during hours marked.
		F_N	14 10 ..	.....	.....	.....	.....	
9	.....	.....	.....	.....	.....	.....	.....	Sinusoidal wavelets recurring during day. Weaker but more frequent than on the 8th.
13	.....	L_N	19 14 ..	.....	.....	.....	.....	Extremely small and irregular waves at intervals during day.
		F_N	19 18 ..	.....	.....	.....	.....	
15	.....	L_N	17 20 ..	.....	.....	.....	.....	Somewhat doubtful as to being seismic.
	.....	F_N	17 23 ..	.....	.....	.....	.....	

District of Columbia. *Washington. U. S. Weather Bureau.*

Lat., 38° 54′ 12″ N.; long., 77° 03′ 03″ W. Elevation, 21 meters.

Instrument: Marvin (vertical pendulum, undamped. Mechanical registration).

Instrumental constants:

V	T_0
110	6.4

1917.			H. m. s.	Sec.	μ	μ	km.	
Apr. 9	.....	e.	20 57 30	.....	.....	.....	.....	Missouri quake. Minute but distinct tremors with very short period superimposed on microseisms.
		F	20 58 38	.....	.....	.....	.....	
21	.....	e?	1 06 45	.....	.....	.....	.....	
		i.	1 13 23	.....	.....	.....	.....	
		F	1 50 ..	.....	.....	.....	.....	
22	.....	e?	6 23 50	.....	.....	.....	.....	Doubtful as to being seismic.
		M	6 32 30	.....	.....	.....	.....	
		M	6 34 22	.....	.....	.....	.....	
		M	6 35 16	.....	.....	.....	.....	
		F	6 45 00	.....	.....	.....	.....	
28	.....	e.	16 16 32	.....	.....	.....	.....	Phases indistinguishable.
		M_E	16 20 38	.....	23	.....	.....	
		F	16 45 00	.....	.....	.....	.....	
29	.....	e?	12 02 50	.....	.....	.....	.....	
		e?	12 16 56	.....	.....	.....	.....	
		eL	12 45 00	20	.....	.....	.....	
		F	13 01 00	.....	.....	.....	.....	

District of Columbia. *Washington. Georgetown University.*

F. A. Tondorf, S. J.

Lat., 38° 54′ 25″ N.; long., 77° 04′ 24″ W. Elevation, 42.4 meters. Subsoil: Decayed diorite.

Instruments: Wiechert 200 kg. astatic horizontal pendulums, 80 kg. vertical.

Instrumental constants:

	V	T_0	e
E	165	5.4	0
N	143	5.2	0
Z	80	3.0	0

1917.			H. m. s.	Sec.	μ	μ	km.	
Apr. 21	.....	e?	1 05 14	.....	.....	.....	.....	P very uncertain. Heavy microseisms present.
		iS_E	1 13 22	.....	.....	.....	.....	
		iS_N	1 13 23	.....	.....	.....	.....	
		F	1 50 00	.....	.....	.....	.....	
22	.....	e.	6 24 41	.....	.....	.....	.....	Phases very difficult to distinguish.
		F	6 52 00	.....	.....	.....	.....	
28	.....	e?	16 16 23	.....	.....	.....	.....	Heavy microseisms present. No distinct maximum.
		e_N	16 16 28	.....	.....	.....	.....	
		S.	16 20 19	.....	.....	.....	.....	
		eL_N	16 21 05	.....	.....	.....	.....	
		eL_E	16 21 10	.....	.....	.....	.....	
		F	16 57 00	.....	.....	.....	.....	
29	.....	L_E	12 45 34	.....	.....	.....	.....	Very heavy microseisms present.
		L_N	12 45 51	.....	.....	.....	.....	
		F	12 55 00	.....	.....	.....	.....	

TABLE 2.—*Instrumental reports, April, 1917*—Continued.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neuman.

Lat., 21° 19′ 12″ N.; long., 158° 03′ 48″ W. Elevation, 15.2 meters.

Instrument: Milne seismograph of the Seismological Committee of the British Association.

Instrumental constant.. T_0 18

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1917.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 3	.....	e.....	13 25 18	.....	.....	.....	.....	
		L.....	13 37 36	24	.....	.....	.....	
		M.....	13 46 36	.....	*500	.....	.....	
		C.....	13 51 00	.....	.....	.....	.....	
		F.....	14 04 00	.....	.....	.....	.....	
5	.....	L.....	4 35 00	.....	.....	.....	.....	Times uncertain; motion of paper not uniform.
		M.....	4 23 18	.....	*200	.....	.....	
		C.....	4 45 00	.....	.....	.....	.....	
12	.....	e.....	3 40 48	.....	.....	.....	.....	
		eL.....	3 50 06	20	.....	.....	.....	
		M.....	3 56 00	.....	*400	.....	.....	
		C.....	3 59 48	.....	.....	.....	.....	
		F.....	4 08 —	.....	.....	.....	.....	
15	.....	eP.....	12 29 24	.....	.....	.....	.....	
		L.....	12 39 06	20	.....	.....	.....	
		M.....	12 42 18	.....	*100	.....	.....	
		C.....	12 45 00	.....	.....	.....	.....	
		F.....	12 49 00	.....	.....	.....	.....	
16	.....	eP.....	19 30 48	.....	.....	.....	.....	
		eL.....	19 42 54	.....	.....	.....	.....	
		M.....	19 49 00	19	*100	.....	.....	
		C.....	19 53 00	.....	.....	.....	.....	
21	.....	eP.....	1 23 12	.....	.....	.....	.....	
		eL.....	1 33 54	20	.....	.....	.....	
		M.....	1 35 30	.....	*100	.....	.....	
		C.....	1 43 00	.....	.....	.....	.....	
23	.....	eL.....	0 46 00	20	.....	.....	.....	
		M.....	0 46 36	.....	*100	.....	.....	
		F.....	1 43 00	.....	.....	.....	.....	
28	.....	P.....	14 13 00	.....	.....	.....	.....	
		eL.....	14 18 54	21	.....	.....	.....	
		M.....	14 20 54	.....	*200	.....	.....	
		C.....	14 23 42	.....	.....	.....	.....	
		F.....	14 40 —	.....	.....	.....	.....	
29	.....	e.....	12 27 48	.....	.....	.....	.....	
		M.....	12 42 00	20	*100	.....	.....	
		F.....	13 25 00	.....	.....	.....	.....	
29	.....	eP.....	16 20 54	.....	.....	.....	.....	
		eL.....	16 32 30	.....	.....	.....	.....	
		M.....	16 36 24	19	*100	.....	.....	
		F.....	16 44 —	.....	.....	.....	.....	

* Trace amplitude.

Kansas. *Lawrence. University of Kansas.* Department of Physics and Astronomy. F. E. Kester.

Lat., 38° 57′ 30″ N.; long., 95° 14′ 58″ W. Elevation, 301.1 meters.

Instrument: Wiechert.

Instrumental constants..		V	T_0	ϵ
	E	177	3.4	4:1
	N	205	3.4	4:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1917.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 9	.....	P_E.....	20 53 15	.....	.....	.....	.....	Shock felt locally.
		P_N.....	20 53 23	.....	.....	.....	.....	
		S_N?...	20 53 56	.....	.....	.....	.....	
		S_E?...	20 53 57	.....	.....	.....	.....	
		L.....	20 54 12	.....	.....	.....	.....	
		M_E...	20 54 13	.....	.....	.....	.....	Needles left paper at end of maximum.
		M_N...	20 54 14	.....	.....	.....	.....	
		F.....	21 08 —	.....	.....	.....	.....	
9	.....	P.....	23 35 56	.....	.....	.....	.....	P and S very faint.
		S?.....	23 36 29	.....	.....	.....	.....	
		L.....	23 36 45	.....	.....	.....	.....	
		M.....	23 36 47	.....	3	2	.....	
		F.....	23 42 —	.....	.....	.....	.....	
28	.....	P_E or S_E.	16 15 19	.....	.....	.....	.....	
		P_N or S_N.	16 15 24	.....	.....	.....	.....	
		L.....	16 19 32	.....	.....	.....	.....	
		M_E...	16 19 44	3–4	.....	.....	.....	
		M_E...	16 20 07	.....	.....	.....	.....	
		F.....	16 40 —	.....	.....	.....	.....	

Maryland. *Cheltenham. Magnetic Observatory.* U. S. Coast and Geodetic Survey. George Hartnell.

Lat., 38° 44′ 00″ N.; long., 76° 50′ 30″ W. Elevation, 71.6 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants..		V	T_0
	E	10	32
	N	10	27

(No earthquakes recorded during April, 1917.)

Massachusetts. *Cambridge. Harvard University Seismographic Station.* J. B. Woodworth.

Lat., 42° 22′ 36″ N.; long., 71° 06′ 59″ W. Elevation, 5.4 meters. Foundation: Glacial sand over clay.

Instruments: Two Bosch-Omori 100 kg. horizontal pendulums (mechanical registration).

Instrumental constants..		V	T_0	ϵ
	E	80	23	0
	N	50	25	4:1

(Report for April, 1917, not received.)

Missouri. *Saint Louis. St. Louis University.* Geophysical Observatory. J. B. Goesse, S. J.

Lat., 38° 38′ 15″ N.; long., 90° 13′ 58″ W. Elevation, 160.4 meters. Foundation: 12 feet of tough clay over limestone of Mississippi system, about 300 feet thick.

Instruments: Wiechert, 80 kg. astatic, horizontal pendulum.

Instrumental constants..	V	T_0	ϵ
	80	7	5:1

1917.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 9	II_D....	P_E?...	20 52 30	.....	.....	.....	.....	Local shock; period of 4.5 seconds; amplitude 19–20 mm. A very blurred record.
		M.....	20 52 42	.....	.....	.....	.....	
		F.....	21 00 00	.....	.....	.....	.....	
9	II_D....	P_E?...	23 35 06	.....	.....	.....	.....	N–S record too blurred.
		M_E...	23 35 18	.....	.....	.....	.....	
		F.....	23 54 00	.....	.....	.....	.....	
28–29	.....	.....	.....	.....	.....	.....	.....	Hour contact out of order.

New York. *Buffalo. Canisius College.* John A. Curtin, S. J.

Lat., 42° 53′ 02″ N.; long., 78° 52′ 40″ W. Elevation, 190.5 meters.

Instrument: Wiechert 80 kg. horizontal.

Instrumental constants..	V	T_0	ϵ:1
	80	7	5:1

(Report for April, 1917, not received.)

New York. *Fordham. Fordham University.* Daniel H. Sullivan, S. J.

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert, 80 kg.

Instrumental constants..		V	T_0	ϵ
	E	72	6.6	1.5:1
	N	72	7.1	3.8:1

(No record, clock connection out of order.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration).

Instrumental constants..		V	T_0	ϵ
	E	13	22	4:1
	N	14	25	4:1

(Report for April, 1917, not received.)

TABLE 2.—*Instrumental reports, April, 1917*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Panama Canal Zone. *Balboa Heights.* Isthmian Canal Commission.

Lat., 8° 57′ 39″ N.; long., 79° 33′ 29″ W. Elevation, 27.6 meters.

Instruments: Two Bosch-Omori, 100 kg.

Instrumental constants.. V 10, T_0 20

(No earthquake recorded during April, 1917.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. L. Adams.

Lat., 18° 08′ 48″ N.; long., 65° 26′ 54″ W. Elevation, 19.8 meters.

Instruments: Two Bosch-Omori.

Instrumental constants.. V: E 10, N 10; T_0: 18, 18

(No earthquake recorded during April, 1917.)

Vermont. *Northfield. U. S. Weather Bureau.* Wm. A. Shaw.

Lat., 44° 10′ N.; long., 72° 41′ W. Elevation, 256 meters.

Instruments: Two Bosch-Omori, mechanical registration.

Instrumental constants.. V: E 10, N 10; T_0: 15, 16

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1917. Apr. 28	.....	e.....	*H. m. s.* 16 18 00	*Sec.*	μ	μ	*km.*	No phases discernible.
		F.....	16 25 00	.....	.....	.....	.....	

Canada. *Ottawa. Dominion Astronomical Observatory.* Earthquake Station. Otto Klotz.

Lat., 45° 23′ 38″ N.; long., 75° 42′ 57″ W. Elevation, 83 meters.

Instruments: Two Bosch photographic horizontal pendulums, one Spindler & Hoyer 80k. vertical seismograph.

Instrumental constants.. V 120, T_0 26

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1917. Apr. 21	.....	i.....	*H. m. s.* 1 12 50	*Sec.*	μ	μ	*km.*	Masked by microseisms.
		L.....	1 28 .. / 1 37 ..	17	.....	.....	.....	
		F.....	1 50 ..	.....	.....	.....	.....	
28	.....	e_M.....	16 13 21	1-2	.....	.....	.....	
		i_M.....	16 14 18	1-2	.....	.....	.....	
		i_M.....	16 15 14	1-2	.....	.....	.....	
		S_M?...	16 16 54	3	.....	.....	.....	
		S_W?...	16 16 57	2	.....	.....	.....	
		F.....	16 35 ..	.....	.....	.....	.....	
29	.....	L.....	8 57 ..	10	.....	.....	.....	
29	.....	e_M?....	12 05 16	.....	.....	.....	.....	Distance probably of the order of 11,000 km.
		e_W?...	12 05 30	.....	.....	.....	.....	
		e?.....	12 07 29	.....	.....	.....	.....	
		eS_M?..	12 17 22	.....	.....	.....	.....	
		eS_M?..	12 17 34	.....	.....	.....	.....	
		L.....	12 40 .. / 12 44 ..	20	.....	.....	.....	L well marked.
		L_W....	12 47 ..	14	.....	.....	.....	
		F.....	13 05 ..	.....	.....	.....	.....	

Canada. *Toronto. Dominion Meteorological Service.*

Lat., 43° 40′ 01″ N.; long., 79° 23′ 54″ W. Elevation, 113.7 meters. Subsoil: Sand and clay.

Instrument: Milne horizontal pendulum, North; in the meridian.

Instrumental constant.. T_0 18. Pillar deviation, 1 mm. swing of boom=0.50″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1917. Apr. 3	.....	L.....	*H. m. s.* 14 14 06	*Sec.*	μ	μ	*km.*	
		M.....	14 17 18	.....	*200	.....	.....	End in air currents.
12	.....	L.....	4 03 30	.....	*50	.....	.....	
		F.....	4 07 00	.....	.....	.....	.....	
21	.....	L?.....	0 46 18	.....	.....	.....	.....	Microseisms going on.
		L.....	1 07 12	.....	.....	.....	.....	
		L.....	1 34 54	.....	*100	.....	.....	
		F.....	1 43 00	.....	.....	.....	.....	
23	.....	e?.....	1 24 18	.....	.....	.....	.....	Minute thickening.
		e.....	1 25 48	.....	*50	.....	.....	
		F.....	1 47 42	.....	.....	.....	.....	
28	.....	L.....	16 17 36	.....	*50	.....	.....	
		F.....	16 19 54	.....	.....	.....	.....	
29	.....	e?.....	12 11 18	.....	.....	.....	.....	
		L.....	12 38 18	.....	.....	.....	.....	
		L.....	12 39 24	.....	.....	.....	.....	
		eL.....	12 41 24	.....	.....	.....	.....	
		M.....	12 42 54	.....	*300	.....	.....	
		F?.....	13 23 00	.....	.....	.....	.....	

*Trace amplitude.

Canada. *Victoria, B. C. Dominion Meteorological Service.*

Lat., 48° 24′ N.; long., 123° 19′ W. Elevation, 67.7 meters. Subsoil: Rock.

Instruments: Wiechert, vertical. Milne horizontal pendulum, North; in the meridian.

Instrumental constant.. T_0 18. Pillar deviation: 1 mm. swing of boom=0.54″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1917. Apr. 3	.....	P?.....	*H. m. s.* 13 48 30	*Sec.*	μ	μ	*m.*	
		L?.....	13 55 26	.....	.....	.....	.....	
		M.....	14 05 21	.....	*300	.....	.....	
		F.....	14 24 41	.....	.....	.....	.....	
12	.....	M.....	3 58 03	.....	*100	.....	.....	
23	.....	P?.....	1 00 30	.....	.....	.....	.....	
		M.....	1 21 49	.....	*200	.....	.....	
28	.....	e.....	16 16 06	.....	.....	.....	.....	
		e.....	16 16 48	.....	*50	.....	.....	
29	.....	P?.....	12 30 34	.....	.....	.....	.....	
		S?.....	12 32 34	.....	.....	.....	.....	
		L.....	12 34 33	.....	.....	.....	.....	
		M.....	12 38 31	.....	*500	.....	.....	
		F.....	12 49 55	.....	.....	.....	.....	

*Trace amplitude.

SEISMOLOGICAL DISPATCHES.[1]

Tokyo, Japan, Mar. 18, 1917. (Belated dispatch.)

Heavy earthquake felt in Tokyo to-day from 7:20 to 7:30 a. m., local time.

London, Apr. 4, 1917.

Reuter's Melbourne correspondent reports a local earthquake having been felt in towns in northeastern Victoria. A dispatch to Reuter

[1] Reported by the organization indicated and collected by the seismological station at Georgetown University, Washington, D. C.

from Auckland, New Zealand, says a violent eruption of the volcano Waimangu began Sunday and still continues. Two persons have been killed. (Assoc. Press.)

St. Louis, Mo., Apr. 9, 1917.

A distinct earthquake shock was felt for several seconds this afternoon throughout this section. A number of windows were broken and several chimneys were knocked down. The after-vibrations continued for eight minutes. (Assoc. Press.)

[See Table 1 and note hereunder, this issue of the REVIEW.]

Santa Barbara, Cal., Apr. 12, 1917.

A severe earthquake shock was felt here at 8 o'clock to-night. No damage was done. Ventura and Oxnard, 20 and 30 miles east, respectively, along the coast, also felt the shock but experienced no damage. (Assoc. Press.)

Los Angeles, Cal., Apr. 20, 1917.

Two earthquake shocks in rapid succession were felt in various parts of southern California late to-night. No damage was reported. (Assoc. Press.)

London, Apr. 27, 1917, 8:38 a. m.

A violent earthquake in Tuscany and Umbria is reported in a Rome dispatch to the Exchange Telegraph Co. to have occurred on Thursday morning. Many persons are reported killed at Monterchi, near Arezzo, the capital of the Province of that name. Considerable material damage is also reported. (Assoc. Press.)

Rome, Apr. 30, 1917.

Earthquake shocks were reported at Monterchi to-day, the same district laid waste by earth tremors last week. (United Press.)

THE MISSOURI EARTHQUAKE OF APRIL 9, 1917.

By RUY H. FINCH, Assistant.

[Seismological Investigations, Weather Bureau, May 29, 1917.]

On the 9th of April, 1917, a little before 3 p. m., central time, an earthquake occurred near the middle of the eastern border of Missouri that was felt in 10 different States. It was felt over most of Missouri and Illinois, and at many places in Iowa, Wisconsin, Indiana, Kentucky, Tennessee, Mississippi, Arkansas, and Kansas. At first it was thought that the quake had its origin in the New Madrid region, but later reports indicate that the epicenter was somewhere between there and St. Louis.

Most of the information relative to this quake was obtained from some 160 question cards filled out by cooperative observers of the Weather Bureau—postmasters and others—most of whom rendered these reports shortly after the occurrence of the shock while its effects were still fresh in their minds. The majority of the accounts thus received are given in some detail in Table 1, page 182, of this issue of the REVIEW; their intensities and geographical distribution are shown on the accompanying isoseismal map, figure 1.

As was recently pointed out by Montessus de Ballore,[1] the use of isoseismals drawn from estimates of intensities that at best are bound to be at variance is unsatisfactory. Nevertheless such isoseismals give a better idea of the relative distribution of intensities than would be had if omitted.

The area over which this quake was felt, elliptical in shape, extends about 600 miles in a north-south direction and over 500 miles east-west, covering approximately 200,000 square miles. In addition to being both felt and instrumentally recorded at St. Louis University, St. Louis, Mo., and the University of Kansas, Lawrence, Kans., slight records were also obtained at St. Ignatius College, Cleveland, Ohio, about 520 miles away, and the Weather Bureau, Washington, D. C., about 760 miles from the epicentral region.

The beginning of the disturbance as given by the majority of observers was $2^h\ 52^m$ to $2^h\ 53^m$ p. m. (Central time). The time at origin as calculated from the seismograph record of the University of Kansas was $2^h\ 52^m\ 24^s \pm 5^s$. This is in fair agreement with the record obtained at St. Louis University, within a very short distance of the origin, which began at $2^h\ 52^m\ 30^s$ p. m.

Sounds were quite generally reported within the territory bounded by the V isoseismal. Within the VI isoseismal many places reported that heavy rumbling both preceded and accompanied the shock.

No good evidence as to the direction of the vibrations is at hand, though the majority of the observers thought it was east-west. The observer at Ironton, Mo., Mr. W. H. Delano, says that he looked down and could see the earth rock—rise up and sway back and forth as from west to east.

The damage occasioned by this quake was slight. Some windows were broken, bricks shaken from chimneys, and plaster cracked over most of the territory bounded by the VI isoseismal. Several horses were thrown to the pavement in different parts of St. Louis. A painter working on a ladder in Granite City, Mo., was shaken off and fell into a flower garden but was unharmed. Many people hurriedly left their homes in fright. The school children at Warrenton, Mo., and several other places, were thrown into a panic and were dismissed. As is well known, birds and many other animals are more sensitive to light shocks than human beings. This may explain why a team of horses in Golconda, Ill., were uneasy and restless at the time of the quake while the driver felt nothing.

No preliminary shocks to the main quake were noticed except for a slight tremor that was recorded on April 9 by the seismograph at St. Louis University, $8^h\ 45^m$ a. m. A second shock at $5^h\ 35^m$ p. m. was felt quite generally over most of the southern half of the territory bounded by the V isoseismal and was specially noticeable in the corresponding part within the VI isoseismal. This would lead one to think that the origin was located somewhere in the southern half of the VI isoseismal area.

The middle Mississippi Valley, the southern Appalachian region, the Atlantic Coastal Plain in the vicinity of Charleston, S. C., northern and eastern New York, and New England are the well-known seismic regions of the eastern United States. Most, though by no means all, of the middle Mississippi Valley quakes occur in the New Madrid region. Two quakes, one occurring on May 26, 1909, the other on January 2, 1912, and described by Udden [2] apparently had their origin southwest of Chicago. Scarcely a year passes without one or more quakes being felt in the New Madrid region. One on October 7, 1857, whose origin appears to have been either a little to the south of St. Louis or near New Madrid, was not quite as severe as the one under discussion. Another that occurred on October 31, 1895, was probably the most severe since the great shocks of 1811–12. The last shock of note in this region occurred on December 7, 1915, when an intensity of V Rossi-Forel was reported. Several observers ventured the assertion that the quake under discussion was the most severe since the great New Madrid earthquake, and this may be true for the region about St. Louis but is improbable as regards southeastern Missouri.

Judging from the distance to which the waves of this disturbance was propagated it seems probable that the origin was at some depth below the surface. It is known that a series of faults, running in a general east-west direction, occur in the underlying Paleozoic rock of the central region of this earthquake, and it is probable that the recent shake had its origin in one or more of these faults.

[1] Bull., Seis. soc. America.

[2] Trans., Illinois Academy of science, 1912, 5:—